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Interdimensional Correlation of Bodies in Female Ettawa Breed Goats

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Abstract

This study aimed to determine the correlation between body dimensions in female Ettawa crossbreed goats, which had been carried out in Rano Jaya Village, Toari District, Kolaka Regency. The parameters calculated in this study were 21 parameters from 7 body dimensions in goats and 35 study samples. Then the parameters of this study were calculated using the Correlation Coefficient formula to find the level of correlation between body dimensions in female Ettawa crossbreed goats. Based on the results of the study obtained several quantitative properties of female Ettawa crossbreed goat morphology which were observed among them were body surface size. The average linear dimension of the body surface and the standard deviation include: shoulder height (64.12 ± 3.09), chest (29.30 ± 1.72), chest circumference (80.94 ± 5.64), chest width (17.15 ± 1.64), hip height (69.21 ± 2.15), hip width (21.46 ± 3.10) and body length (65.79 ± 4.50) grouped according to physiological status. Calculating of the dimensions of the female Ettawa crossbreed goat body size did not get a perfect correlation, but there were 3 variables that had a very strong (positive) correlation, namely Chest Circumference - Hip Width (0.82), Chest Circumference - Body Length (0.83) and Hip Width - Body Length (0.83). It can be concluded that the dimensions of Ettawa crossbreed female goat's body of 21 variables observed were only three variables which had a correlation value close to 1 indicating a very strong or positively correlated relationship, and it could be said that increasing body size (x) increases body size (y).

Keywords: correlation, body dimensions, and female Ettawa breed goats

A. Introduction

Ettawa breed goat (PE) is the result of a cross between Ettawa goats and Kacang goats that have adapted to Indonesian conditions (Hardjosubroto, 1994). The Ettawa (PE) breed, for

now, has become a particular concern among the community, many people are beginning to be interested in maintaining PE goats as broiler and milk-producing livestock. Several studies have shown that livestock body measurements have many uses, namely giving a description of the body shape of animals, as a characteristic of a particular nation and can be used to estimate body weight (Permatasari, Kurnianto, & Purbowati, 2013). Also, body size data can also be used for livestock selection. The shape and size of the animal's body can be described using optical measurements and measurements. To determine the relationship between body size in female Ettawa breeders in this study uses the Correlation method. Correlation is a term used to measure the strength of relationships between variables. Correlation analysis is a way to find out whether or not there is a relationship between variables. The power of the relationship between variables can be seen from the results of the correlation coefficient value. The correlation coefficient (KK) is an index or number used to measure closeness (strong, weak, or absent) relationships between variables. Therefore, the researchers were interested in examining the Ettawa Peranakan goat in Rano Jaya Village, Toari District, related to the relationship between body measurements in the Ettawa Peranakan goat. Toari Subdistrict, Kolaka Regency is one of the regions that have a large population of Ettawa Peranakan goat breeds, each year the population total of Ettawa Peranakan goats in Toari District is increasing. The population total of goats in Toari District, Kolaka Regency in 2017 was 8,842 (Head of Toari District Animal Husbandry Resort, Livestock Census). One of the factors increasing the goat population is the increasing demand of consumers/people consuming goat meat.

B. Methodology

1. The Material

The research material was 35 Ettawa Breeds (PE) goats. The goats used are adult female goats aged 22-25 months and on average have given birth twice. The equipment used in this study is a measuring stick, measuring tape, digital camera, boot shoes, calculators and stationery as well as table sheets to fill in raw data.

2. Research Procedures

This study uses quantitative methods, namely to obtain measurements of the dimensional characteristics of female PE goat bodies. Determination of location and sampling of PE goats was done by purposive sampling, namely the technique of determining samples with specific considerations (Sugiyono, 2005). The method of sampling locations is by identifying the production center in the sub-districts and villages — a sampling of goats based on specific criteria, namely female sex. The selected sample is then measured by several body sizes as shown in Figure 1.

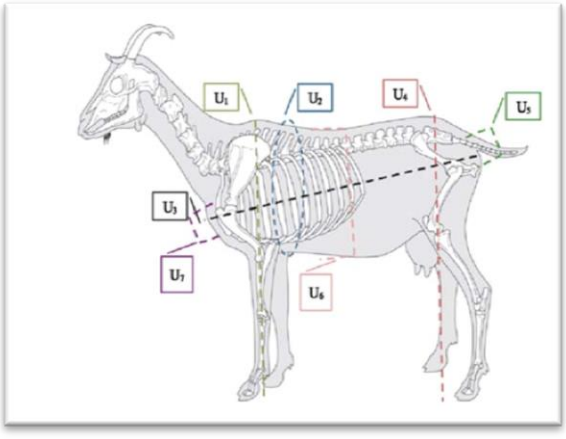

Figure 1. Measurement of Body Dimensions in a Female Ettawa Breed Goat

Description:
1= Shoulder Height (SH)
2= Chest Circumference (CC)
3= Body Length (BL)
4 = Hip Height (HH)
5 = Hip Width (HW)
6 = In Chest (IC)
7 = Chest Width (CW)

The procedures for this study include:

1. Conduct preliminary research as a reference report for research proposals.
2. Determine the livestock used as the research material as many as 35 cattle of female Ettawa breeders aged 22-25 months.
3. Measuring the dimensions of the animal's body.
4. Record the size of the dimensions of the livestock body.
5. Processing data

3. Parameters of Research

Parameters of this study were:

1. Shoulder Height (SH), measured from the highest distance of shoulder to ground level. Measurements are made using a measuring stick in units of cm.
2. Chest Circumference (CC), measured around the chest cavity (body of the sternum) behind the shoulder joint. Measurements are made using a measuring tape in units of cm.
3. Body Length (BL), it measured from a straight line distance from the edge of the humerus os. to the ischium os. Measurements are made using a measuring stick in units of cm.
4. The height of the hip (HH), it measured from the highest distance of the pelvis (lumbar vertebrae) that is perpendicular to the surface of the ground. Measurements are made using a measuring stick in units of cm.
5. Hip width (HW), measured on the hip joint (protrusion of the upper femur bone) between the right and left bones. Measurements are made using calipers in units of cm.
6. In the Chest (IC), it measured by drawing a straight line from the highest peak shoulder to the bottom edge of the chest following a straight line. Measurements are made using a measuring stick in units of cm.
7. Chest Width (CW), measured from a distance between the protrusion of the os shoulder joint at the right and left. Measurements are made using calipers in units of cm

4. Data Analysis

Data obtained, presented descriptively and processed using SPSS and Microsoft Office Excel 2007 programs include average values, standard deviation, and correlation coefficient. Correlation of body dimensions can also be known by using mathematical formulas (Sudjana, 1996).

$$r = \frac{n\,(Sxy) - (Sx).\,(Sy)}{\sqrt{n\,(Sx^2) - (Sx)^2 \quad n\,(Sy^2) - (Sy)^2}}$$

Information:
R: Correlation between body dimensions
n: Number of livestock
x: Variable X
y: Variable Y

The magnitude of the correlation coefficient ranges from +1 to -1. Correlation coefficient shows the strength (strength) of the linear relationship and the direction of the relationship of two random variables. If the correlation coefficient is positive, then the two variables have a direct relationship. It means that if the value of variable X is high, then the value of variable Y will also be high. Conversely, if the correlation coefficient is negative, then the two variables have an inverse relationship. It means that if the value of X is high, then the value of the variable Y will be low (and vice versa). To facilitate the interpretation of the strength of the relationship between the two variables the authors provide the criteria as follows (Jonathan & Sarwono, 2006).

0: There is no correlation between the two variables
> 0 - 0.25: Correlation is very weak
> 0.25 - 0.5: Enough correlation
> 0.5 - 0.75: Strong correlation
> 0.75 - 0.99: Correlation is very strong
1: Perfect correlation

C. Result and Discussion

1. Body Morphology of Female Etawa Breed Goats

Morphology is the study of animal body shapes. Bones and muscles form the body of the animal. The distance between bones or between joints is used as a parameter of livestock growth. The parameters of livestock growth are the results of measurements of the distance between bones or between joints which are called body measurements. Body measurements are factors that are closely related to the growth performance of livestock so that they are used in performance tests (Hardjosubroto, 1994) and the estimation of body weight (Setiadi, Priyanto, & Martawijaya, 1997).

Based on the results of the study obtained several quantitative properties of female Ettawa crossbreed goat morphology which were observed among them were body surface size. The average linear dimension of the body surface and standard deviation include shoulder height, chest, chest circumference; chest width, hip height, hip width and body length grouped according to physiological status.

Table 2. Average Value and Standard Deviation of Body Dimensions in Female Ettawa Breed Goats

Body Dimension	Average and Standard Deviation (cm)
Body Length	65,79 ± 4,50
Shoulder height	64,12 ± 3,09
Hip height	69,21 ± 2,15
Chest size	80,94 ± 5,64
Chest Width	17,15 ± 1,64
In the chest	29,30 ± 1,72
Hip width	21,46 ± 3,10

a) Body Length

Body length is one of the body sizes that have a high level of variation; this is caused by age and sex factors where the more age increases, the more body size of livestock and sex, male body size is much higher than the size female cattle body. Based on the results of the study, the average and standard deviation of the body length of female Ettawa crossbreed goats was 65.79 ± 4.50 cm. Differences in body size can be seen in previous studies such as those obtained by Setiadi et al. (1997), where the body length of adult female goats was 50.33 ± 6.72 cm. Victori, Andi, Purbowati, & Lestari (2016) showed that body size differences were 79.08 ± 3.72. It indicated that the body length of male Ettawa crossbreed goats aged 24-26 months was much higher than the body length of female Ettawa breeders. Whereas the standard deviation value of 35 samples of female Ettawa Peranakan goats was based on the results of the study showed that the length of the body had a good level of uniformity in researching body size. The most important thing to consider is the age of livestock, in determining the age of animals and must be more specified because age can cause a high level of uniformity of research data.

b) Shoulder height.

Based on the results of the study, the average and deviation of the shoulder height of female Ettawa crossbreed goats were 64.12 ± 3.09 cm. Shoulder height in Ettawa crossbreed goats is one size that has different sizes; this is very much influenced by age and sex, where sex is one of the most influential factors because of the size of the shoulder of the distant Ettawa crossbreed goat different from female Ettawa breeds. When compared with the results of the study by Setiadi, et al. (1997) obtained a measure of shoulder height in adult Ettawa breeders of 52.00 ± 7.38 cm. It shows that the size of shoulder height is much higher based on the results of the study. But the results of a study by Novita (2015) showed that the height of female Ettawa Peranakan goats in Pelaihari's BPTU KDI-HPT farm group was much higher at 76.18 ± 2.90. The standard deviation value from the research results is 3.09 cm, this figure shows that the research data obtained an excellent level of uniformity of 35 high-size samples of female Ettawa crossbreed goat shoulder.

c) Hip height.

Hip height is a body size that is related to the size of the shoulder height, meaning that the higher the size of the shoulder, the higher the height of the hip. Based on the results of the study, the height of the female Ettawa breed hip was 69.21 ± 2.15 cm; this result was higher than that

obtained by Setiadi et al. (1997), namely 58.40 ± 1.67 cm. But this value is close to the effects of Novita's study (2015), namely the high size of female Ettawa breeders' hips at DAY Farm, which was 71.84 ± 5.20. The size of the hip height is very varied; this is due to the age factor where the increasing age of the livestock the more height the size of the hip increases.

The standard deviation value of the research results is 2.15 cm, this figure shows that the research data obtained an excellent level of uniformity from 35 high-size samples of female Ettawa crossbreed goat should.

d) Chest size.

Based on the results of the study, female Ettawa breeds goats had an average yield, and standard deviation with a chest circumference size was 80.94 ± 5.64 cm. Chest circumference body size is one body size that is directly related to body weight, where the more massive body weight of the goat, the wider the circumference of the chest circumference of the goat. The body size of the chest circumference is very often used to determine animal body weight. It is presumably because the chest circumference is directly related to the chest and abdominal space where most of the animal's body weight comes from the chest to the hips, Soeparno (1992) states that every increase in body size will be followed by the rise in other body sizes.

When compared with some previous studies, this figure is very much higher than that obtained by Setiadi, et al. (1997), where the chest circumference of adult female goats was 64.77 ± 5.80 cm. But from the results of a study by Novita (2015) the height of female Ettawa breeders' hips at DAY Farm farms was 83.52 ± 6.0, this figure can be said that the size of the chest circumference from the results of the study was almost the same as that obtained by the study by Novita (2015). The value of the standard circumference of the chest circumference from the results of the study was 5.80 cm, this figure indicates that the research data obtained a relatively good level of uniformity from 35 samples of the size of the chest circumference of female Ettawa Breeds goats.

e) Chest Width

Based on the results of the study, female Ettawa crossbreed goats had an average yield and standard deviation with a chest width measure of 17.15 ± 1.64 cm. Chest width body size is the lowest value because in general, the size of the chest width in Ettawa breeders does not have a full scale because the characteristic of Peranakan Etawa goats is their slender shape. The width of the chest size can be compared with the results of the study of Novita (2015) the size of the chest width of female Ettawa breeders at the DAY Farm, which is 17.78 ± 2.40. These results indicate that the size of the chest width from the results of the study is almost the same as that obtained by Novita (2015), it can be said that the size of the chest width is not much different from the width of the chest of the Ettawa crossbreed goat in other regions.

Based on the standard deviation value of the chest width from the results of the study is 1.64 cm, this figure shows that the data obtained from the study results obtained an excellent level of uniformity of 35 samples of the width of the chest of female Ettawa Breeds.

f) In the chest

Based on the results of the study, female Ettawa breeds goats had an average yield, and the standard deviation with the size of the chest was 29.30 ± 1.72 cm. Body size in the chest was one body size that has a high level of variation. One of the factors that significantly affect body size is age. If the period of livestock is different, then body size is also different because at the age of goats entering the growth phase will be different from the age of the goat in the development phase. It compared with the results of research conducted by Novita (2015) who obtained the average value and standard deviation of female Ettawa Peranakan goats at DAY Farm farms that were 31.31 ± 2.56. This result is not much different from the average size in the chest of the Ettawa Breed goat based on the results of the study with the average size in the chest of the Ettawa crossbreed goat on the DAY Farm farm. While the standard deviation value in the chest from the results of the study is 1.72 cm, this figure indicates that the data obtained from the study results obtained an excellent level of uniformity of 35 size samples in the breasts of female Ettawa Breeds goats.

g) Hip width.

Based on the results of the study, female Ettawa breeds goats had an average yield, and standard deviation of hip width was 21.46 ± 3.10. When compared, this value is higher than that

obtained by Novita (2015), the width of the hips of Ettawa female breeders' goats, which are 19.75 ± 1.76. The width of the bones is influenced by the age factor, where the age of the cattle increases, the width of the bones also increases. While the standard deviation value of the hip width from the results of the study was 3.10 cm, this figure indicates that the data obtained from the study results obtained a relatively good level of uniformity from 35 wide-size samples of female Ettawa breeds.

Differences from several dimensions of the female Ettawa crossbreed goat's body size with several comparisons between previous studies, it can be seen that there are variations in body dimensions. It is due to factors of age and sex besides that it is also influenced by genetic differences, according to Noor's statement (2008) due to genetic and environmental effects and interactions between genetics and environment. Several factors also influence variations in the dimensions of the body of the goat, according to Bugiwati (2007), besides genetic factors, maintenance management systems and environmental factors affect the development of animal body measurements. Sukowarsih (2013) states that differences in linear measurements of PE goat's body surface are due to differences in maintenance management which involves farmers' policies in breeding and feeding programs.

2. Interdimensional Correlation of Bodies in Female Ettawa Breeds Goats.

Based on the results of the study, the size of the body dimensions of female Ettawa crossbreed goats showed the overall results of 21 research parameters were positively correlated, namely getting a correlation with the dimensions of the Ettawa crossbreed goat's body size. Mulliadi, (1996) explains that measurements of the linear size of body surfaces are carried out to obtain differences in body measurements in livestock populations. Body measurements are very useful as a selection variable because they have a considerable value of heritability and diversity (Diwyanto, 1982).

Table 3. Inter-dimensional Body Correlation Coefficient in Female Ettawa Breed Goats.

Interdimensional Body Correlation		Correlation Coefficient	Information
Parameter (x)	Parameter (y)		
Chest Size	In the Chest	0.64	Strong Correlation
Chest Size	Chest Width	0.53	Strong Correlation
Chest Size	Hip Width	0.82	Very Strong Correlation
Chest Size	Shoulder Height	0.49	Enough Correlation
Chest Size	Hip Height	0.26	Enough Correlation
Chest Size	Body Lenght	0.83	Very Strong Correlation
In the Chest	Chest Width	0.55	Strong Correlation
In the Chest	Hip Width	0.61	Strong Correlation
In the Chest	Shoulder Height	0.66	Strong Correlation
In the Chest	Hip Height	0.18	Very Weak Correlation
In the Chest	Body Lenght	0.65	Strong Correlation
Chest Width	Hip Width	0.53	Strong Correlation
Chest Width	Shoulder Height	0.59	Strong Correlation
Chest Width	Hip Height	0.44	Enough Correlation
Chest Width	Body Lenght	0.47	Enough Correlation
Hip Width	Shoulder Height	0.53	Strong Correlation
Hip Width	Hip Height	0.17	Very Weak Correlation
Hip Width	Body Lenght	0.83	Very Strong Correlation
Shoulder Height	Hip Height	0.36	Enough Correlation
Shoulder Height	Body Lenght	0.50	Enough Correlation
Hip Height	Body Lenght	0.13	Very Weak Correlation

Based on the results of the study, there were four correlation results between the dimensions of female PE goats, namely powerful correlation, strong correlation, enough correlation, and a very weak correlation. The results of the correlation coefficient can be seen in Table 3.

a) Very Strong Correlation

The correlation of body measurements has a stable relationship ($P < 0.01$) in this study, namely chest circumference - hip width (0.82), chest circumference - body length (0.83) and hip

width - body length (0, 83). These results indicate that the relationship between body measurements correlates or has a reliable correlation between the two parameters. It can be said that the more body size (x) increases body size (y). The body size can be used as a benchmark for estimating the body weight of female Ettawa crossbreed goats because the two parameters correlate very strongly or have a very close relationship by the opinion of Supranto (1996), which states that the correlation value close to 1 indicates a stable and positive relationship between two variables. Correlation is equal to + 1 meaning that both variables have a perfect linear relationship (forming a straight line) positive. Perfect correlation like this has a sense if the value of X rises, then Y also rises.

Based on the results of the study, the values of the correlation coefficients in the above three parameters indicate a positive correlation (+) or body size chest circumference - hip width, chest circumference - body length and hip width - body length shows a direct correlation. According to Muhidin (2007) if the Correlation Index Number is marked plus (+) then the correlation is positive and the direction of one-way correlation, whereas if the Correlation Index Number is minus (-), then the correlation is negative and the course of the correlation is the opposite; and if the Correlation Index Number is 0, then this indicates no correlation.

b) Strong Correlation

Based on the results of the study found a strong correlation coefficient of 8 variables, namely the correlation between chest circumference - in the chest (0.64), chest-chest circumference width (0.53), in chest - chest width (0.55), in chest - hip width (0.61), in chest-shoulder height (0.66), chest - body length (0.65), chest width - hip width (0.53) and chest width-shoulder height (0.59). Indicating that the correlation of the above parameters is a direct correlation (positive) and shows a strong correlation, this body size cannot be used as a benchmark to determine the body weight of female Ettawa Breed goats because between each of the two parameters above does not have a Correlation Coefficient value very high. Parameters between body size above can be said that the increasing body size (x) increases body size (y), but the cost of the increase in size is not high by the opinion of Jonathan, & Sarwono (2006) shows the standard Correlation value is strong (0.50 – 0.75). As revealed by Setiadi, Priyanto, Sudaryanto, & Subandriyo (1994), a strong correlation might occur not as a result of direct mutual influences, but due to one or more other factors that influence both characteristics. Factors that affect body size increase are environmental factors, system maintenance, age, and sex.

c) Enough Correlation

In accordance with the standard value of the enough correlation used by Jonathan, & Sarwono (2006), which is> 0.25 - 0.50, based on the results of this study body size is obtained which the value of correlation enough correlation is: Chest circumference - shoulder height (0.49), circumference chest - hip height (0.26), chest width - hip height (0.44), chest width - body length (0.47), shoulder height - hip height (0.36) and shoulder height - body length (0 , 50), shows a direct correlation (positive) but the correlation value is weak or enough correlation, so it can be concluded that enough correlation of the six parameters above shows that increasing body size (x) increases body size (y), but the value is not significant because of the enough correlation.

d) Very Weak Correlation

Based on the results of the study, a very weak correlation value (P> 0.05) showed almost no correlation between the observed variables, from the results of this study there were 3 variables which showed a very weak correlation namely in the chest - hip height (0.18), width hip - hip height (0.17) and hip height - body length (0.13). The results of this correlation show a direct correlation (positive), but the correlation coefficient is very low and almost said to not correlate. The size of this body dimension cannot be used as an ingredient for performance assessment in female Ettawa breeders, because the correlation coefficient value is very weak between body dimensions in female Ettawa breeds.

D. Conclusion

Based on the results of the study, 21 parameters observed for body dimensions in female Ettawa crossbreed goats produced a direct or positive correlation and three variables which obtained a very strong correlation value. Chest Circumference, Hip Width, and Body Length are body measurements that can be used as benchmarks for estimating animal body weight because

it has a stable relationship, and it can be said that increasing body size (x) increases body size (y).

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